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Additional Analysis Vippetangen

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CONTENTS

1.	Introduction	1
2.	Existent Traffic path	2
3.	Alternatives	3
3.1	Alternative 1	4
3.2	Alternative 2	8
3.3	Alternative 3	11
4.	Summary and Conclusion	13
5.	Appendix	14

1. Introduction

This report presents three alternatives for managing the traffic congestion caused by ferry arrivals and exiting traffic in the area Vippetangen, Norway. The objective is to create and assess different approaches to deal with the traffic caused by ferry arrivals. And mitigate it's the negative effects on the surrounding areas.

The analysis period covers the off-peak traffic from 8:30 am to 11:30 am on a typical weekday.

The three alternatives developed are presented in detail in Section 3.

2. Existent Traffic path

Figure 1 shows the current route for ferry traffic heading westbound on E18. The current “blue route” presents several challenges, notably navigating five closely spaced intersections leads to frequent stop-and-go situations, causing delays, increased fuel consumption, and higher CO2 emissions.

Additionally, the queue forming along Skippergata can disrupt the flow of vehicles exiting from E18, raising safety concerns for network users. These challenges highlight the need for improvements in managing traffic flow in the area.

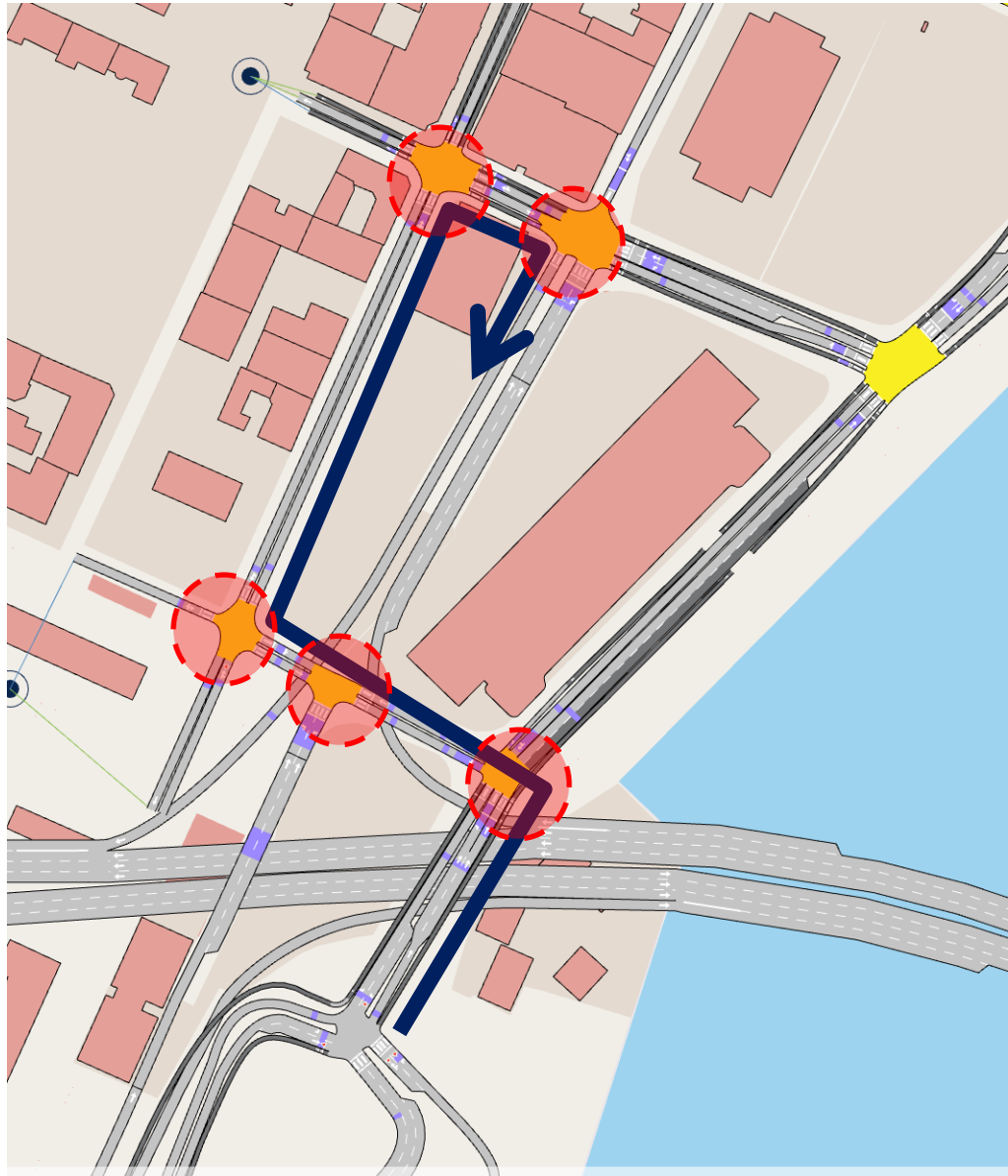


Figure 1 Existent Traffic Path through E18 - Westbound direction

3. Alternatives

Three distinct alternatives were created to handle the traffic resulting from ferry arrivals. Among these options, two underwent evaluations through simulations.

The analysis encompassed traffic conditions from the end of the morning peak until noon (8:30-11:30). Simulated traffic period is illustrated in the figure. It should be noted that the performances of the alternatives might fluctuate during peak traffic hours.

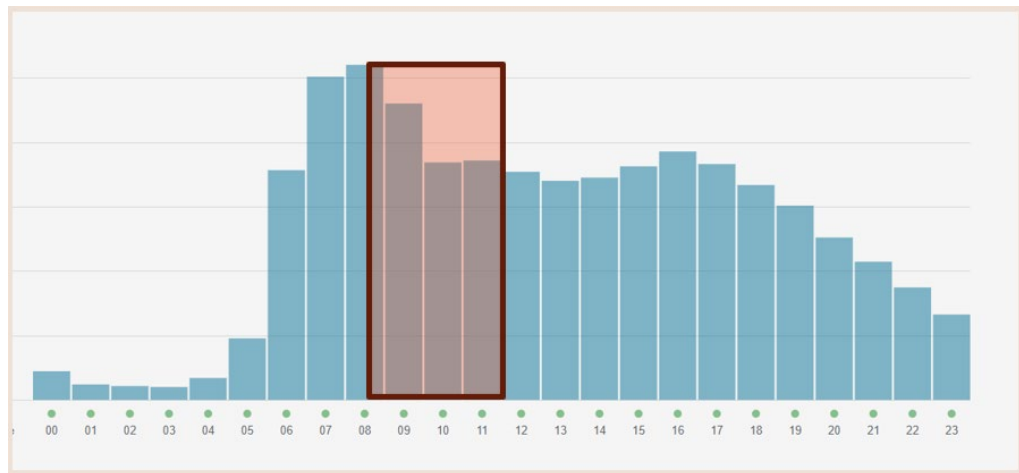


Figure 2 Daily traffic distribution and simulated period (highlighted in red)

3.1 Alternative 1

A new alternate route for traffic traveling from the harbor to the westbound E18 has been implemented. This new route reduces the number of intersections vehicles need to pass through, aiming to improve traffic flow. See Figure 3 for details.

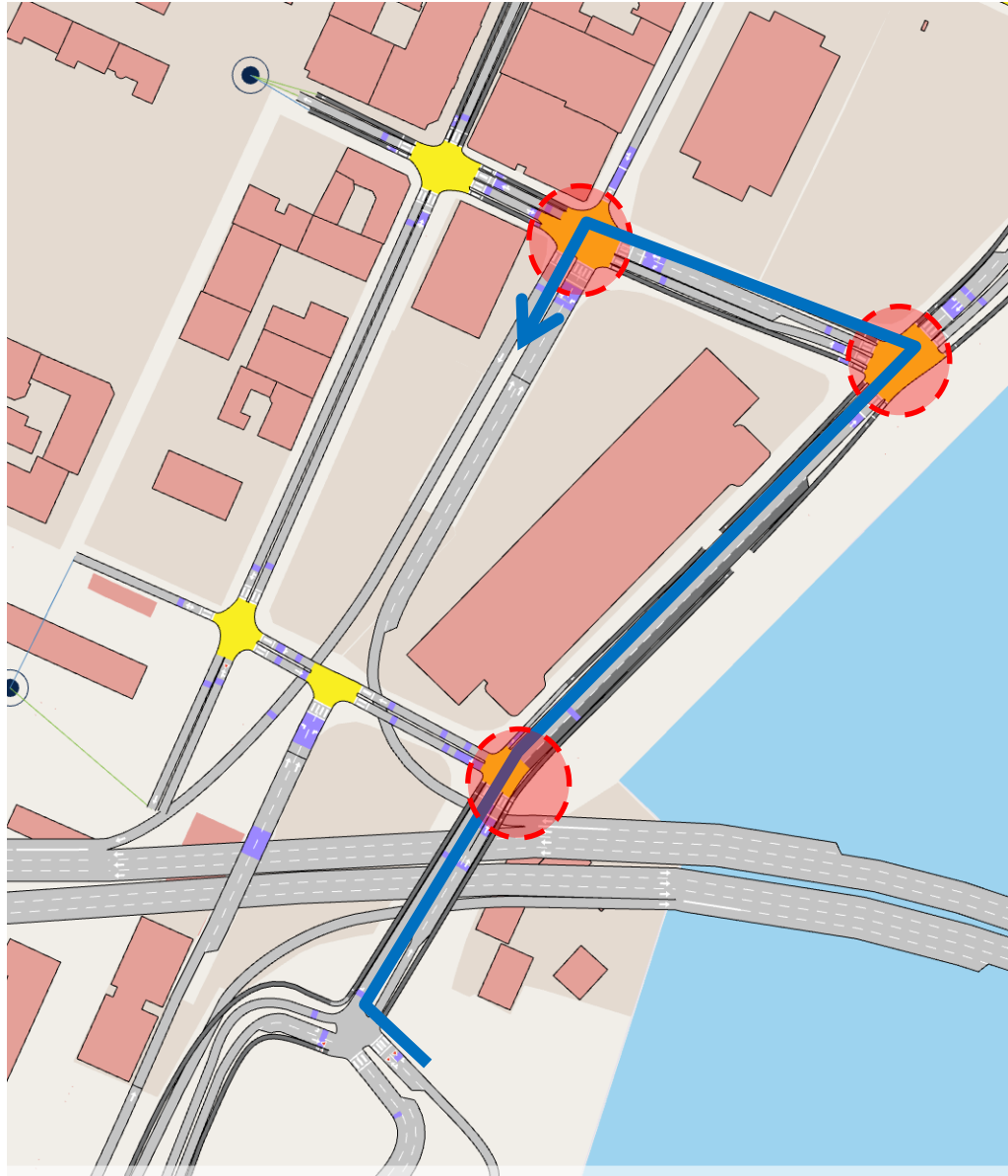


Figure 3 Alternative 1 – Proposed Path Details

To accommodate the chosen path, lane configurations at the intersection Langkaia x Radhusgata have been modified. Specifically, as shown Figure 4, northbound traffic is now allowed to move straight or turn left through a shared turn lane.

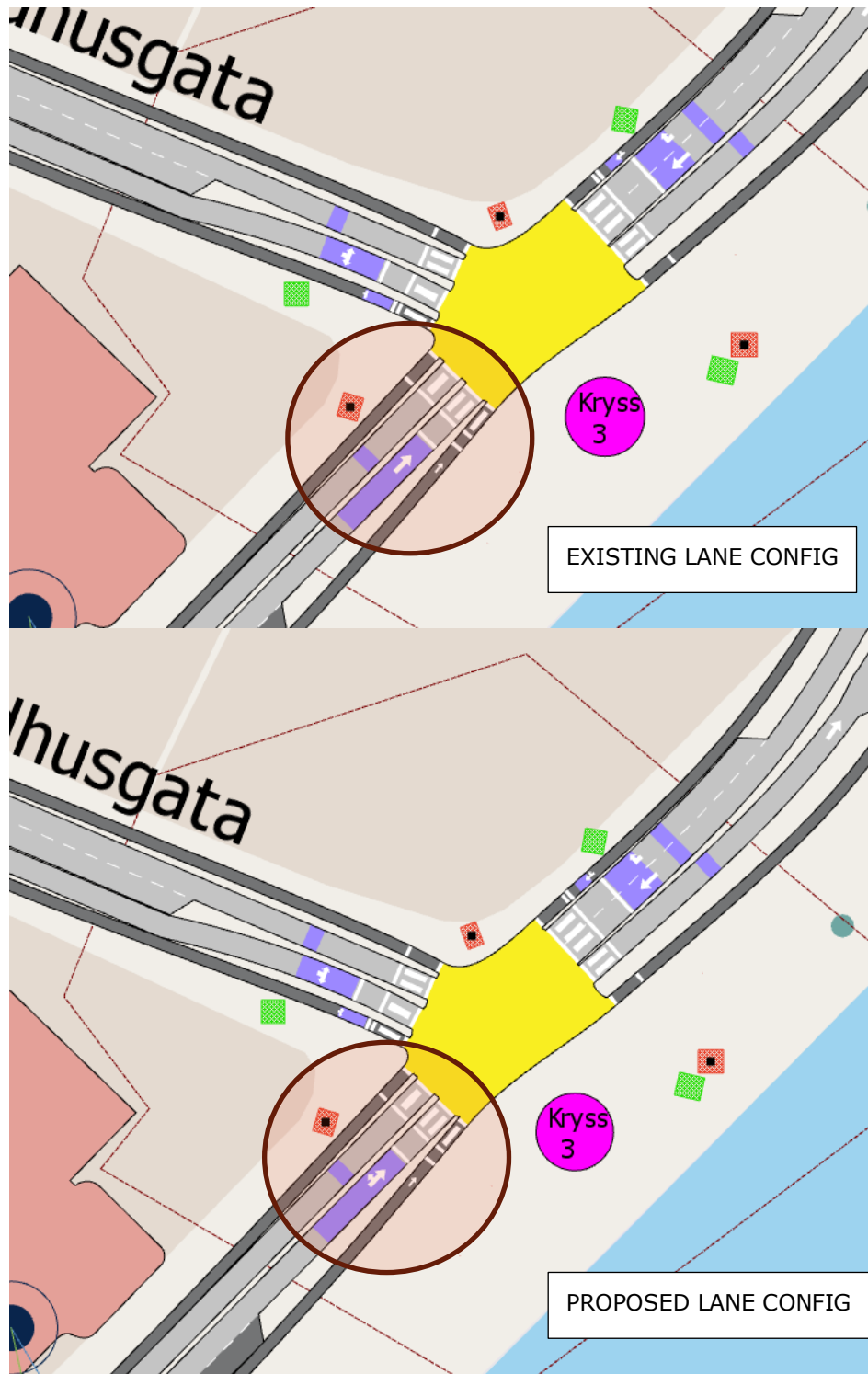


Figure 4 Proposed lane configuration details

Due to the modified lane configuration at the Langkaia x Rådhusgata intersection, the corresponding timing plan has also been revised. The existing phase diagram in Figure 5 has been updated. In the new control plan, southbound and northbound phases are separated, eliminating conflicts, and maximizing safety.

The details of the new phase diagram are presented in Figure 6. The green phase for interval 1 has been split into new phases while maintaining 90 seconds cycle time and coordination with neighboring intersections.

The new timing plan incorporates detectors and is programmed for both actuated and coordinated operations. This allows for efficiently transferring unused green time to other phases, ensuring the maximum intersection capacity.

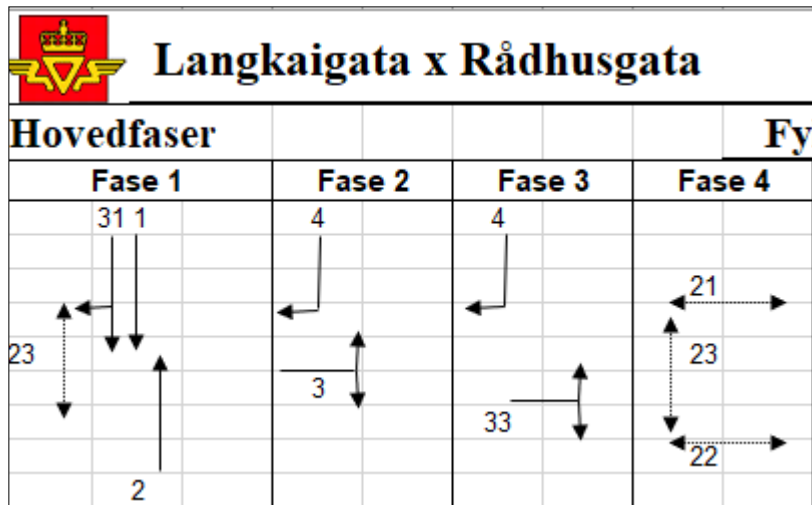


Figure 5 Existing Phase Diagram

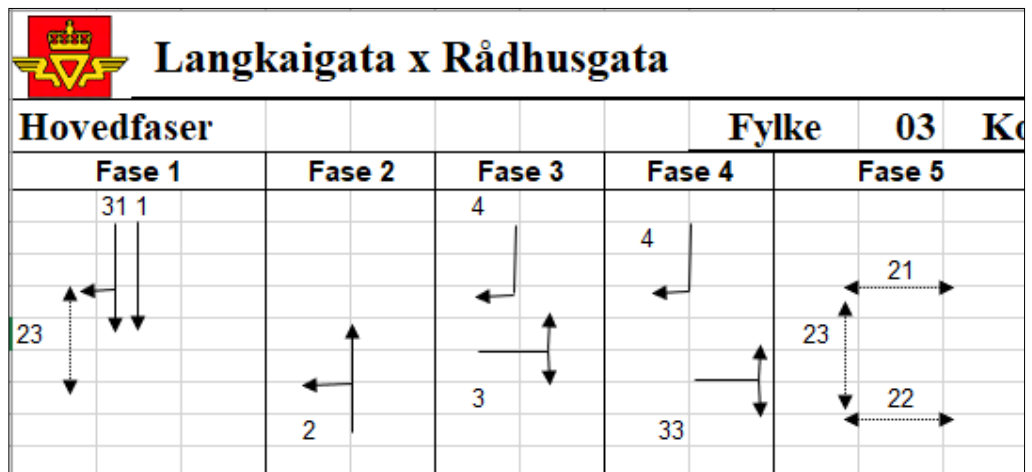


Figure 6 Proposed Phase Diagram

AIMSUN simulations of the developed alternative revealed that the reduced green time and shared northbound left turn lane along Langkaia caused increased delays and queuing.

To address the negative impacts of reduced green times from movement 1 and 2 (shown in phase diagram, Figure 6), the timing of green signals has been adjusted at two marked intersections in Figure 7.

At Langkaia x Radhusgata intersection (intersection #1 in the figure), the green signal for northbound traffic starts earlier than the green signal for E18 ramp traffic at intersection E18 ramp x Grev Wedels Plass (intersection #2 in the figure). This allows the queue along Langkaia to clear before the vehicles from the E18 ramp reach the Langkaigata x Radhusgata intersection. However, there is still a reduction in capacity that is being experienced.

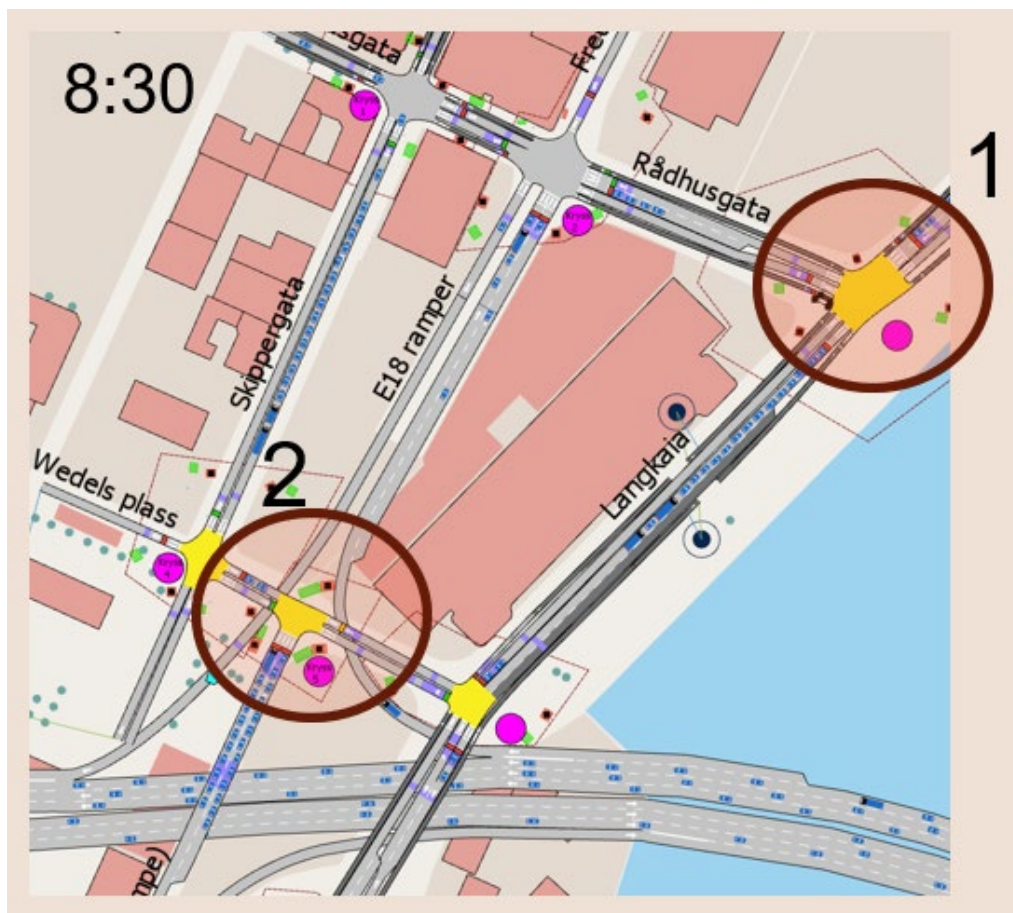


Figure 7 Study area

3.2 Alternative 2

Building upon Alternative 1's new ferry route, Alternative 2 was developed and capacity problems was tried to be addressed by increasing the number of lanes along Langkaia (Figure 8).

In alternative 2, as shown in the Figure 8, the number of lanes on this section has been increased from one to two, facilitating uninterrupted flow and improving capacity. Additionally, separate left-turn and through lanes have been implemented to further prevent congestion and capacity enhancement.

While Alternative 2 utilizes the same phase diagram as Alternative 1, the increased capacity at Langkaia x Radhusgata intersection, with separate left-turn and through lanes, aims to alleviate the queuing problems experienced previously, particularly those caused by reduced green time for northbound traffic in Alternative 1.

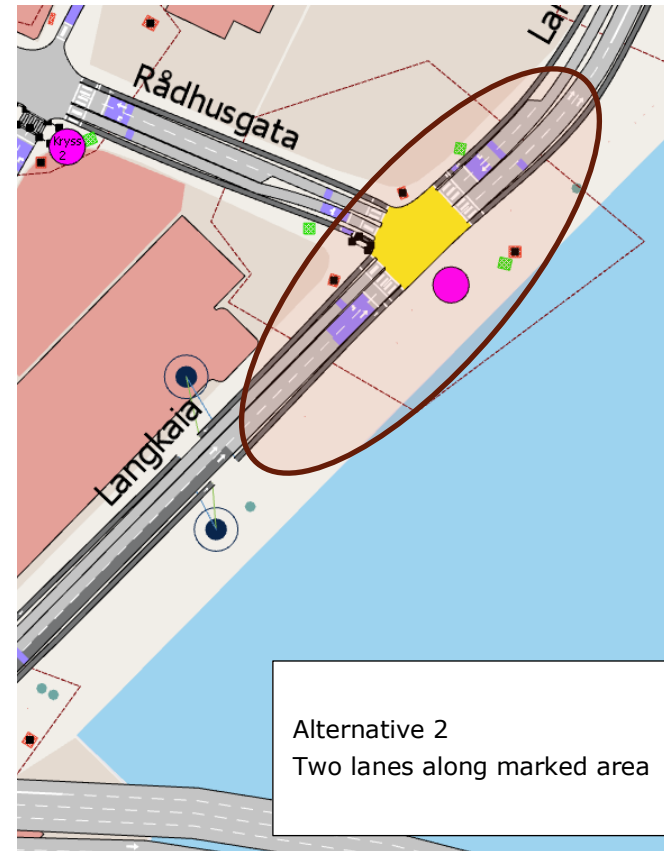


Figure 8 Alternative 2 Lane Configuration Details

AIMSUN simulations of Alternative 2 revealed that the new lane configuration significantly benefited westbound traffic traveling from the harbor to the E18 highway. This alternative helped minimize their travel time and improve the overall traffic flow.

However, this change had a limited positive impact on traffic coming from the E18 ramp and traveling along Langkaia. Most of these drivers continue northbound along Langkaia and were negatively impacted by the reduced green time for northbound through traffic.

3.3 Alternative 3

Unlike Alternatives 1 and 2, which utilized a new route for traffic from Harbor to E18 Westbound, Alternative 3 focuses on optimizing traffic flow with the existing routes (Figure 9).

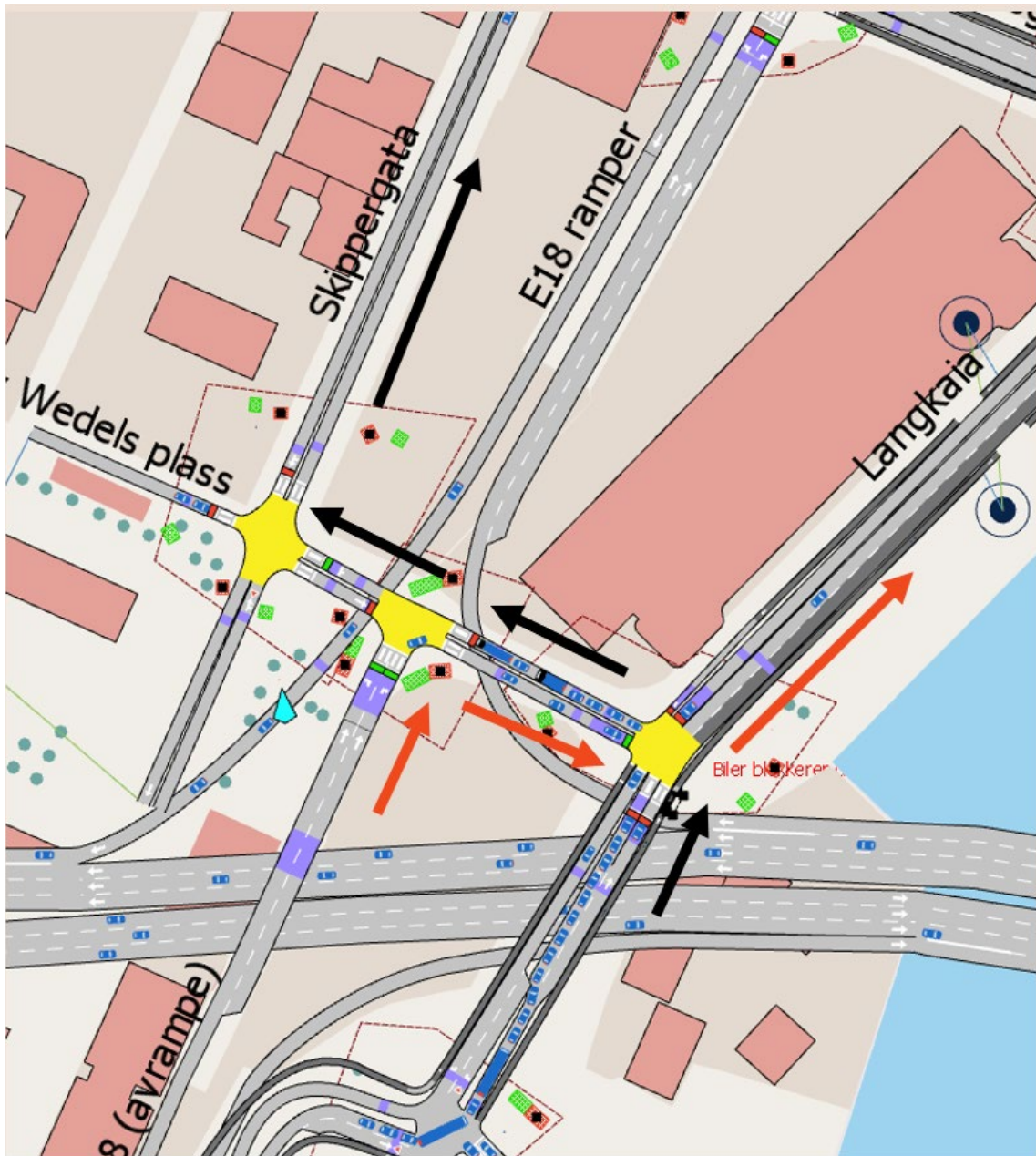


Figure 9 Existing Routes of Ramp Traffic and Traffic from Harbor

Analysis of the existing timing plan and simulations revealed that current control plans and coordination are designed for the primary path marked in red (Figure 9). This approach prioritizes minimizing queues on the E18 off-ramp. However, during off-peak hours and when ferry arrives, traffic flow patterns shift, with the black arrow path experiencing increased volume compared to other parts of the network.

Therefore, Alternative 3 proposes a dynamic control plan. During off-peak hours and ferry arrivals, a different control plan and coordination system will be activated, prioritizing traffic coming from the harbor instead of the E18 ramp traffic.

It's important to note that while this alternative eliminates the need for geometric changes, its performance has not yet been tested due to time constraints and optimization needs.

4. Summary and Conclusion

Improving Traffic Flow from the Harbor:

This report summarizes three alternative strategies to improve traffic flow from the harbor upon ferry arrival, while also aiming to optimize overall traffic performance within the study area.

Maintaining Existing Coordination System:

All proposed timing plans for each alternative were limited to the existing cycle length of 90 seconds to maintain the current coordination system within the network.

Alternatives 1 and 2: New Path for Harbor Traffic

Both alternatives 1 and 2 introduced a new path for harbor traffic heading E18 westbound. This new path aimed to minimize the number of intersections that vehicles will pass through and potential traffic conflicts.

While both alternatives shared this route, they differed in their specific lane configurations:

Alternative 1: Northbound and southbound traffic were controlled with separate phases. At the Langkaia x Radhusgata intersection, northbound through and left-turn traffic shared a lane.

Alternative 2: This alternative utilizes the same control plan as alternative 1. However, the number of lanes along Langkaia through and from the Langkaia x Radhusgata intersection was increased from one to two.

Additionally, through and left-turn traffic is separated at the south side of the intersection. This alternative offered the best performance for ferry traffic by minimizing traffic conflicts and increasing the road capacity and the flow.

However, alternative 2 also negatively impacts traffic traveling from the E18 onto Langkaia due to reduced green time.

Further analysis was recommended during morning and afternoon peak hours to assess the full impact.

Alternative 3: Dynamic Control Plans for Existing Path

Unlike the previous alternatives, alternative 3 utilized the existing path but proposed implementing different signal control plans based on the time of day.

This alternative was considered the most economical and straightforward to implement, but its performance was not tested due to project time constraints.

5. Appendix

Vippetangen – Ny rute for vestgående trafikk

Trafikkmodell Vippetangen - alternativ løsning:

Hypotesen er at det vil bli mindre kø på lokalveinettet og kjøppere tomning av terminalen ved å la trafikken gå langs østsiden av Havnelagerbygget. Trafikken vil måtte passere igjennom 3 lyskryss, istedenfor 5.

Forutsetninger:

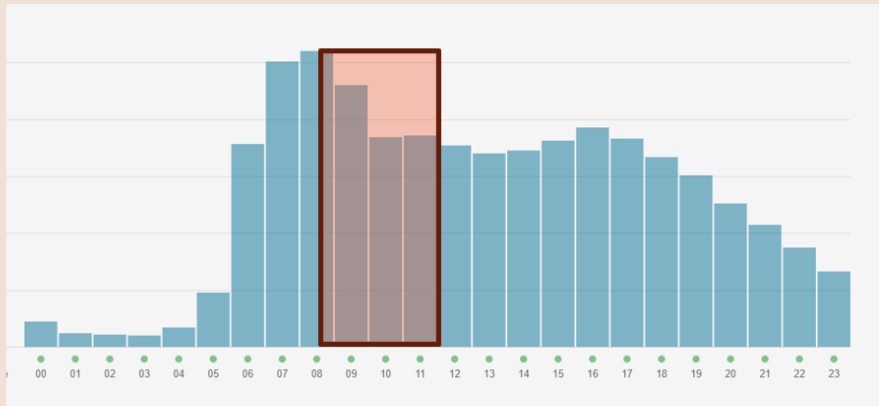
- 1 time antøpstid mellom hver ferge
- All trafikk rett ut i rundkjøringen midt på terminalområdet
- Østgående trafikk ned i tunellen
- Vestgående trafikk langs østsiden av Havnelageret
- Lyskryss 400, 404, 403 tilpasset et "havnemodus" med prioritet til trafikken fra terminalen.
- Lyskryss 404 åpnes opp for venstresving. Trafikkøyer fjernes.
- Gående fra terminalen og på havnepromenaden må ikke krysse utgående trafikk fra terminalområdet, da de går på en gangvei over terminalområdet



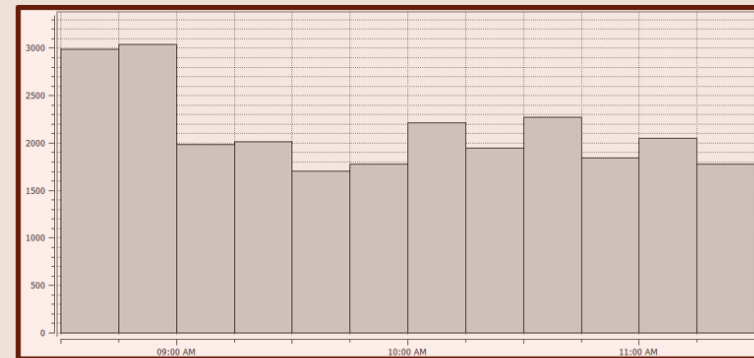
Sjekk av 2 alternativer

- Alternativ 1 – Åpner for venstresving fra Langakaia inn mot Grev Wedels plass
- Alternativ 2 – som alt 1, men ekstra felt langs Langkaia inn mot krysset i nordgående retning

Typical Daily Traffic Distribution



- This study mainly focuses on the traffic period after the morning peak.
- The purpose of the study is to analyze the management of ferry traffic.



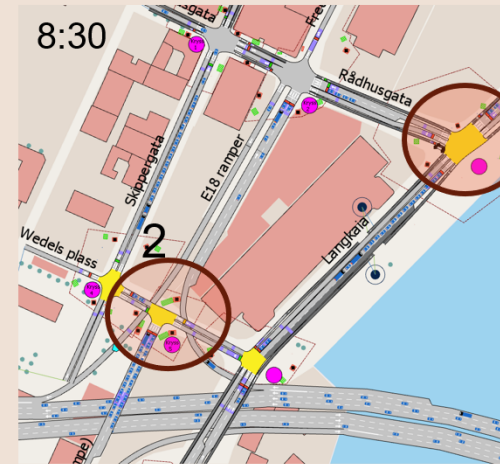
Dagens lyskryss

Langkaigata x Rådhusgata		404	
Hovedfaser		Fylke 03 Kommune 01	
Fase 1	Fase 2	Fase 3	Fase 4
Fasevekslinger		Vegnavn / retning	
Virkemåte		Styreapparat	
Rent tidstyrt		Apparat:	
Tidstyrt m/ lokal modifikasjon	X	Leverandør:	
Tidsstyrt med samkjøring	X	Med kryss:	403,404
Trafikkstyrt		Idriftsatt:	
Spot		Spot kr. nr.:	Spot omr. nr.:
			RSMPid

- Maks Syklus – 90 sekunder
- In all tested alternatives cycle time was kept the same for coordination

ALTERNATIVE 1

Langkaigata x Rådhusgata						404	
Hovedfaser						Fylke 03	Kommune 01
Fase 1	Fase 2	Fase 3	Fase 4	Fase 5	Fase 6		
31 1 23	4 3	4 33	21 23 22				
Fasevekslinger			Vegnavn / retning				
Virkemåte			Styreapparat				
Rent tidstyrt				Apparat:			
Tidstyrt m/ lokal modifikasjon	X			Leverandør:			
Tidstyrt med samkjøring	X	Med kryss:	403,404	Idriftsatt:			
Trafikkstyrt		Lyskryss					
Spot		Spot kr. nr.:	Spot omr. nr.:	RSMPid			



Intersection #1 turns green before intersection #2

So;

- Initial queue along Langkaia
- Queue Along ramp are MINIMIZED



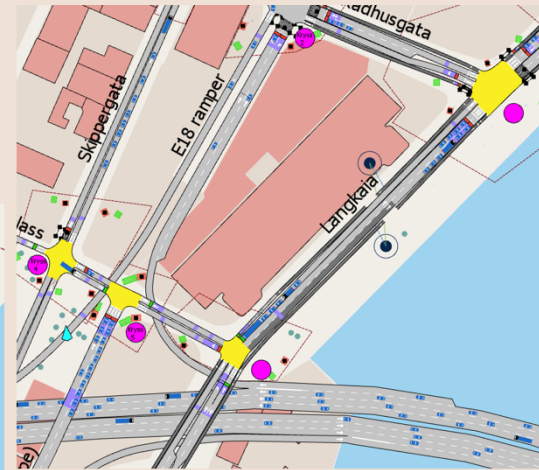
Advantages

- Cost efficient

Disadvantages

- 5 phases
- Less total green time, longer red time, longer waiting
- Longer queues can be seen during peak periods.

ALTERNATIVE 2 Increase in # of lanes



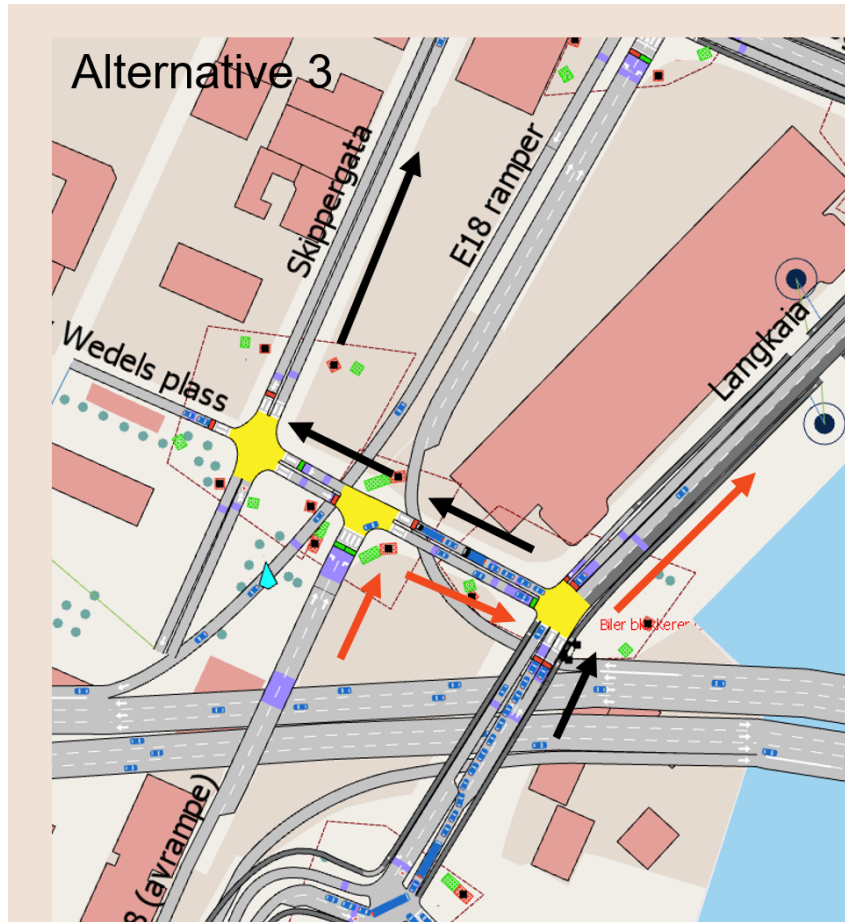
- Number of lanes along Langkaia increases
- Through and left turn traffic separated
- Timing Plan updated
- Less green time but more capacity provided

Advantages

- Capacity increase
- Works for peak traffic

Disadvantages

- Cost
- Construction/space



Priority of paths can be changed

- During AM and PM peak
 - Coordination modelled based on red route
 - All unused times were given to red path
- During Ferry arrival Priority order should be changed to black route and all unused times should be given to black route.

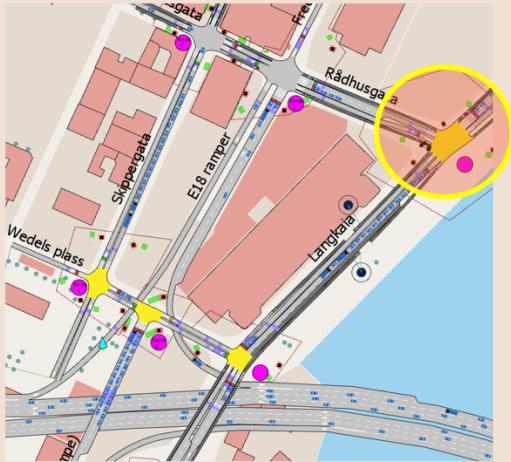
Advantages

- Cost efficient
- Easy to implement

Disadvantages

- Require optimizations

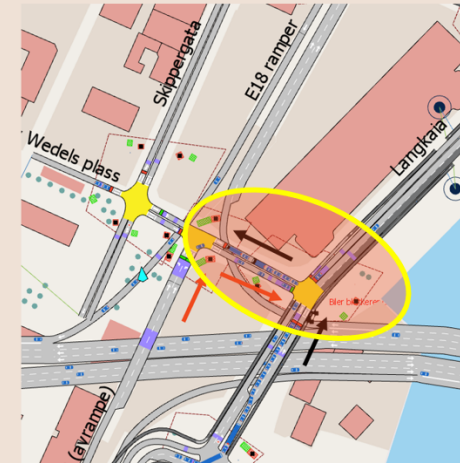
Summary



Alternative 1
Control Plan Change



Alternative 2
Control Plan Change
Geometry Change



Alternative 3 - Extra
Control Plan Change

	Alternative 1		Alternative 2		Alternative 3	
	Ramp traffic	Other traffic	Ramp traffic	Other traffic	Ramp traffic	Other traffic
Normal traffic hours	Worse	Worse	A little worse	Worse	Same	Same
Ferry hours	Worse	A little better	A little worse	A lot better	Worse	Probably Better